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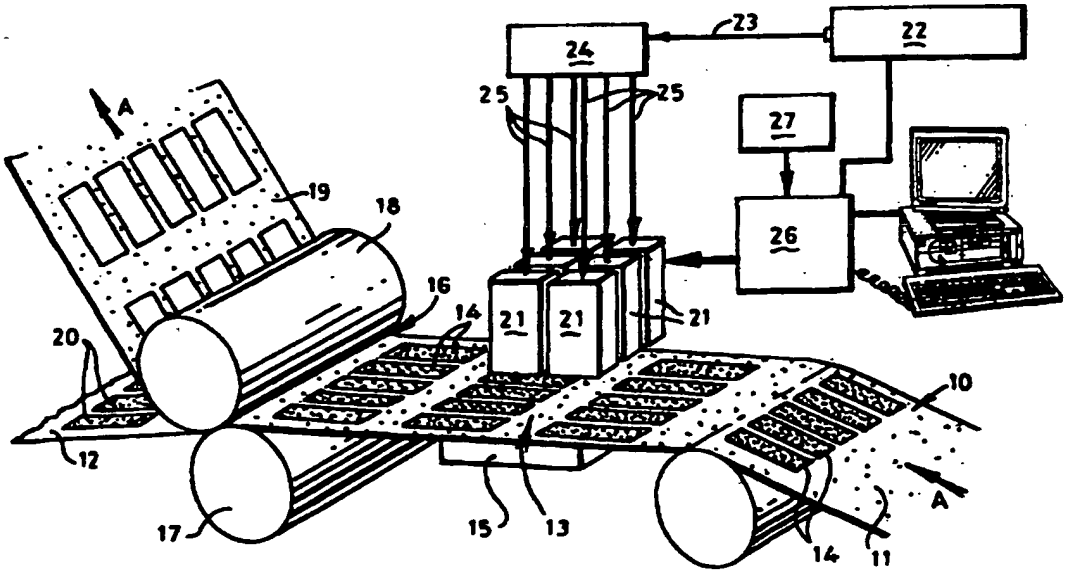
(54) Title: CUTTING OF LABELS



(57) Abstract

Apparatus for and a method of cutting out self-adhesive labels (14) pre-printed on label stock (14) laminated with a release sheet (12) includes a plurality of cutting heads (21) each of which is controlled by a computer storing a digitised representation of the required label shape. Each cutting head (21) is supplied with a laser beam (25) and serves to focus and deflect that beam onto the web (10) of label stock. The power of the laser beam is controlled so that the beam cuts through only the label stock (11) and not the release sheet (12) with which that stock is laminated. Each cutting head (21) is configured to cover only a part of the overall width of the label stock so that there will be only small variations in the path length of the laser beam from the cutting head (21) to the label stock (11), so allowing good control of the focus and cutting power of the beam.

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CUTTING OF LABELS

This invention relates to apparatus for and methods of cutting labels out of a web of label stock.

A very widely used method for the manufacture of self-adhesive labels comprises supplying to a converting machine a web of self-adhesive label stock laminated to a silicon coated release liner. The labels are printed as required and then subjected to a die-cutting step where the required external shape of each label is cut into the label stock, but not the release liner, in register with the printed matter. A die having cutting edges appropriately configured for the label shape is employed for this purpose, the edges projecting from the die surface to a very small extent so that the liner is not cut.

In a continuous converting machine, the label-cutting die is in the form of a drum which co-operates with a backing roller, the web of printed label stock passing through the nip defined by the drum and the backing roller. Subsequent to the die-cutting process, the waste label stock is stripped away from the liner, leaving a series of labels releasably adhered to the liner, ready for application to products. Generally, the liner carrying the labels is reeled until required for use, though sometimes the liner is transferred directly to a labelling machine.

The manufacture of a die for use in a die-cutting process as described above is a highly complex and skilled operation, in order that the die may accurately cut through the label stock, and yet not cut through the liner. Errors in the manufacture of the die will result either in imperfectly cut labels, or in the liner itself being cut. In the former case, the labels may be stripped away with the waste label stock matrix, whereas in the latter case the liner is likely to break during subsequent handling steps, leading to

down-time, wastage and loss of productivity.

A further problem associated with the die-cutting step is that any accumulation of dust or other material on the die will lead to imperfect cutting, since the die will tend to tip slightly, to one side. Moreover, it is also known for the silicon coating on the liner to be of a non-uniform thickness and again this can lead to die-tipping and consequent imperfect cutting. Further problems will result should the label stock itself not be of a constant thickness, or if the thickness of the label stock changes from one reel to another.

The manufacture of a die is an extremely expensive operation, in order that the required die-cutting qualities may be achieved. Moreover, such a die is wholly inflexible, in that once the shape of a label has been decided, it cannot thereafter be changed: if a differently shaped label is required, then a new die must be manufactured, together with the attendant cost.

Having regard to the disadvantages discussed above for conventional label manufacturing die-cutting steps, the present invention aims at reducing those and providing apparatus and a method which is relatively cheap to implement and which allows changes in label shapes easily to be accommodated, along with reliable label cutting.

According to one aspect of the present invention, there is provided apparatus for cutting labels out of a web of label stock laminated with a release liner, which apparatus comprises means to feed the web along a path through a cutting station, a plurality of cutting heads disposed at the cutting station and arranged transversely across the width of said path, at least one laser arranged to supply a light beam to each of said cutting heads, each cutting head having focussing means for focussing a supplied beam on to the label

stock at the cutting station and deflection means to control the point on the label stock where the focussed beam is incident thereon, and control means for all of the cutting heads to cause each light beam incident on the label stock to describe a pre-determined trace.

According to a second aspect of the present invention, there is provided a method for cutting labels from a web of label stock laminated with a release liner and employing apparatus having a plurality of cutting heads disposed at a cutting station and arranged transversely across a path of advancement of the web through the cutting station, at least one laser arranged to supply a light beam to each of said cutting heads, each cutting head having focussing means for focussing a supplied beam on to the label stock at the cutting station and deflection means to control the point on the label stock where the focussed beam is incident, in which method the web of label stock is advanced through the cutting station, the or each laser is energised to supply a light beam to each of the cutting heads, and the focussing means and the deflection means are dynamically controlled to cause the beam from each cutting head to describe on the advancing label stock a part of the required label outline shape.

There have previously been proposals for cutting labels from label stock using a cutting laser, but it has been found that the laser will tend to cut through the silicon liner as well as the label stock. If the power of the laser is reduced to ensure that only the label stock is cut, then the area which may be covered by that laser is relatively small and inadequate for the cutting of a typical self-adhesive label used in commerce, or for cutting across the width of a typical web of self-adhesive label material. A solution to the above problem has been proposed in WO 94/14605; in

this, the label stock is separated from the backing release liner and then a laser is used to cut the outline of each label from the stock. After that, the stock is relaminated with the liner. This process allows the use of a sufficiently powerful laser to ensure cutting of the label shape, right across the web, and there will of course be no cutting of the release liner, as that is separated from the label stock.

In the present invention, the problem identified above has been solved by providing a plurality of cutting heads each of which is able to cover only a relatively small area of the web out of which a label is to be cut. In this way, sufficient control of the cutting depth of the laser beam from each cutting head may be achieved, since the variation in the distance between the cutting head and any point in the area covered by that cutting head on the web is relatively small, and the focus of the laser beam may be accurately maintained.

If the apparatus (or the method) of this invention is incorporated within a converting machine for the manufacture of labels from a web of label stock, the production of a label of any given shape is relatively easy and does not involve the relatively high cost for the manufacture of a die having the required label shape. Moreover, it is easy to adjust or change the shape of the label being produced, again with no high overhead cost which is usually associated with this.

The control means will normally include a computer running a program in which a required label shape has been loaded, the computer providing appropriate outputs to the cutting heads to cause the traces of the incident light beams to describe the required label shape on the label stock. Such a computer may be a dedicated process controller, or could comprise a

conventional high performance PC.

Conveniently, a digitiser is associated with the computer, whereby a required label shape may be loaded into the program by scanning and digitising a graphical representation of the required label shape. If then the label shape is to be changed, this may easily be done by redrawing the label, and then scanning that new drawing. Alternatively, the label shape could be programmed into the computer by conventional programming techniques.

A converting machine incorporating apparatus of this invention may operate on a continuous basis - that is to say, the web of laminated label stock and liner moves continuously, rather than step-by-step. The computer may synchronise the operation of the cutting heads to the advancement of the web, in order that the trace on the web of the beams from all of the cutting heads accurately describes the required label shape. Alternatively, the web could be advanced in steps, with the cutting process being appropriately controlled.

The number of cutting heads required will depend upon the width of the web from which labels are to be cut, and also the speed of advancement of the web through the cutting station. For example, in a typical application, there may be six heads arranged in two groups of three, each group extending across the width of the web. In this way, an area of typically 400mm x 270mm may be covered by the cutting heads. In another embodiment, two cutting heads may be sufficient, arranged side-by-side across the web.

A single laser may be provided, to direct to each cutting head a laser beam. The beam from the laser may be divided by conventional beam division techniques, so that a beam portion is supplied simultaneously to each cutting head. Alternatively, the beam may be directed successively to each cutting head, in a time-division

multiplexed manner. Yet another possibility would be to provide more than one laser; depending upon the number of cutting heads, there may be an individual laser for each cutting head, or each laser may service more than one cutting head.

Each cutting head may be similar to the others, and of a known form for use with a laser, for causing controlled deflection of a laser beam. For example, each cutting head may include a reflecting surface mounted for movement under the control of a magnetic or electrostatic field generated dependent upon the path that the laser beam is to follow, to cut out the required label outline, or part thereof. In preferred embodiments, as discussed above, the magnetic or electrostatic field is generated under the control of a computer into which the required label shape (or part thereof) has been loaded.

The or each laser source may comprise any of a number of low cost laser devices the power of which can be controlled. The most preferred source is a CO_2 laser, though for some applications, a YAG or other laser source could be employed.

By way of example only, certain specific embodiments of the present invention will now be described in detail, reference being made to the accompanying drawings, in which:

Figure 1 shows diagrammatically a first embodiment of laser label cutting apparatus arranged in accordance with the invention;

Figure 2 diagrammatically illustrates a second embodiment of laser label cutting apparatus of this invention; and

Figure 3 diagrammatically illustrates a third embodiment of such apparatus.

Referring initially to Figure 1, there is shown the cutting station of a laser cutting apparatus for

cutting labels from a web 10 of label stock, along with the other important components of the apparatus. The web 10 comprises self-adhesive label stock 11 laminated to a silicon coated release liner 12 (on the underside, on the right-hand side of the drawing). The web 10 is drawn from a reel thereof and is fed along a path in the direction of arrow A so as to be supplied to a cutting station 13. Rather than being drawn directly from a reel, the web may arrive at the cutting station following conversion of the web into a plurality of labels 14 printed thereon.

At the cutting station, the web passes over a vacuum clamp 15 while the pre-printed labels are cut out of the label stock 11, before the web passes through a nip 16 defined by stripping rolls 17 and 18. The waste label stock matrix 19 is reeled for disposal, while the liner 12 carrying individual labels 20 is separately reeled for subsequent use in a labelling machine.

The labels are cut out of the label stock by means of a plurality of laser cutting heads 21, arranged in two groups extending across the width of the web. A CO_2 laser 22 supplies a beam 23 to a beam splitting device 24, the output of which comprises six separate beam portions 25, one such beam portion supplied to each laser cutting head 21.

Within each laser cutting head, there is provided an active lens allowing dynamic focussing of the beam on to the label stock 11, and also galvanometer-controlled mirrors to provide deflection of the beam from the true optical axis of the cutting head. Both the active lens and the mirrors of each cutting head are under the control of a computer 26, running an appropriate program.

Laser cutting heads of the kind described above are known per se, usually as a part of a laser marker,

for example for the marking of alpha-numerics, logos, graphics and other special characters on articles supplied to such a marker. For that application, the power of the laser must closely be controlled in order not to damage the article being marked. Moreover, the area which may be covered by such a single laser cutting head is relatively small and so a known form of laser marker would not be suitable for the cutting of labels from a web of label stock, as described above, since the marker could not cover a sufficiently large area of the web 10 to define a significant part, or even the overall outline of a required label.

The computer may be loaded with an image of the label shape to be cut by means of a scanner 27 which produces a digitised image of a graphical representation of the required label shape. Then, the computer may control the operation of the cutting heads 21 such that these describe the required shape for each label to be cut from the stock, and synchronise the operation of the cutting heads with the advancement of the web. Should it be required to change the label shape, this may easily be achieved merely by scanning a graphical representation of the new label shape.

The labels shown in Figure 1 are relatively small and it might be possible for the entire shape of each label to be defined by only two cutting heads, arranged length wise of the web 10. More typically, there may be only one or two labels across the width of the label stock 11. In such a case, each laser cutting head defines a relatively small part of the entire label outline. In this way, the change in length of the laser beam, from the cutting head to the point where the beam impinges on and cuts the label stock, will be very small, and so the focus of the beam may be maintained. Consequently, the power of the laser may remain constant and the cutting of the label stock may

be achieved reliably, without cutting of the release liner 12.

Though not shown in Figure 1, it will be appreciated from the above that in a typical case where the labels are printed sequentially along the stock 11, each label taking up most of the width of the stock, all six laser cutting heads 21 shown in Figure 1 will be involved in cutting the outer periphery of each label.

Though it would be possible for the apparatus to operate with the web 10 running continuously through the cutting station, the control of the cutting beams would be much complicated by this. Accordingly, it is preferred for the apparatus to operate with the web advanced stepwise, the web being held stationary with each label under the assembly of cutting heads 21 to permit the cutting action on the stationary web.

Figure 2 illustrates a modified form of laser cutting apparatus as described above, with certain parts omitted for clarity. Parts common with those of Figure 1 are given like reference numerals and will not be described again here.

In the arrangement of Figure 2, there are again six cutting heads 21 arranged in two rows across the width of the web 10, but each cutting head 21 is provided with an individual laser source 22. Each laser source directs its beam to a deflection mirror 29, whereby a beam enters the cutting head 21 for appropriate deflection under the control of the computer, to define the appropriate part of the overall label outline. Such a system is simpler to operate and control than that described in Figure 1, even though there is a greater initial cost in view of the greater number of laser sources which have to be provided.

Figure 3 illustrates yet another arrangement, again corresponding generally to that of Figure 1, but

simplified in that only two laser sources 22 are provided, each of which directs a beam to a respective cutting head 21. The two cutting heads are disposed across the path of advancement of the web 10, whereby each may define a part only of the outline of a label to be cut from the web. In the event that the label has a greater length in the direction of advancement of the web than can be covered by each cutting head, the web may be advanced in a series of steps for each label to be cut, each cutting head then performing a cutting action when the web is stationary.

The embodiments of label cutting apparatus described above are easy to use and lend themselves to short production runs, as well as large volume label production. The costs associated with the setting up of the equipment to cut a particular label shape are very small as compared to the conventional technology of employing a die expressly configured for the required label shape. Moreover, the cutting characteristics of each cutting head may be adjusted to suit variables such as the nature of the label stock and its thickness, in order to achieve reliable cutting without causing significant damage to the release liner.

CLAIMS

1. Apparatus for cutting labels out of a web of label stock laminated with a release liner, which apparatus comprises means to feed the web along a path through a cutting station, a plurality of cutting heads disposed at the cutting station and arranged transversely across the width of said path, at least one laser arranged to supply a light beam to each of said cutting heads, each cutting head having focussing means for focussing a supplied beam on to the label stock at the cutting station and deflection means to control the point on the label stock where the focussed beam is incident thereon, and control means for all of the cutting heads to cause each light beam incident on the label stock to describe a pre-determined trace.

2. Apparatus as claimed in claim 1, wherein the control means includes a computer running a program in which a required label shape has been loaded, the computer providing appropriate outputs to the cutting heads to cause the traces of the incident light beams to describe the required label shape on the label stock.

3. Apparatus as claimed in claim 2, wherein each of the incident light beams describes a part only of the overall outline of a label.

4. Apparatus as claimed in claim 2 or claim 3, wherein a digitiser is associated with the computer, whereby a required label shape may be loaded into the program by digitising a graphical representation of the required label shape.

5. Apparatus as claimed in any of claims 2 to 4, wherein the web feed means advances the web continuously, and the operation of the cutting heads is synchronised with the advancement of the web.

6. Apparatus as claimed in any of claims 2 to 4, wherein the web feed means advances the web stepwise,

and the cutting heads are arranged to perform a cutting action on the web only when the web is stationary.

7. Apparatus as claimed in any of the preceding claims, wherein the cutting heads are arranged in two groups, the cutting heads of each group being arranged transversely across the width of said path.

8. Apparatus as claimed in claim 7, wherein the cutting heads of the two groups are arranged in a rectangular array of regular form.

9. Apparatus as claimed in any of claims 5 to 7, wherein more than one laser is provided, one for each group of cutting heads respectively.

10. Apparatus as claimed in any of the preceding claims, wherein a vacuum clamping arrangement is provided below the web at the cutting station.

11. Apparatus as claimed in any of the preceding claims, wherein waste self adhesive label material is stripped away from the cut labels carried on the release liner.

12. A method for cutting labels from a web of label stock laminated with a release liner and employing apparatus having a plurality of cutting heads disposed at a cutting station and arranged transversely across a path of advancement of the web through the cutting station, at least one laser arranged to supply a light beam to each of said cutting heads, each cutting head having focussing means for focussing a supplied beam on to the label stock at the cutting station and deflection means to control the point on the label stock where the focussed beam is incident, in which method the web of label stock is advanced through the cutting station, the or each laser is energised to supply a light beam to each of the cutting heads, and the focussing means and the deflection means are dynamically controlled to cause the beam from each cutting head to describe on the advancing label stock a

part of the required label outline shape.

13. A method as claimed in claim 12, wherein a graphical representation of the label outline is digitised and loaded into a program running in a computer, and the program controls the operation of each laser cutting head dependent upon the required overall label shape.

14. A method as claimed in claim 12 or claim 13, wherein the light beam from the laser is divided into a plurality of portions, each said portion being supplied to a respective cutting head.

15. A method as claimed in claim 12 or claim 13, wherein the light beam is sequentially supplied to each of the cutting heads in turn in a time-division multiplexed manner.

16. A method as claimed in claim 12 or claim 13, wherein each cutting head has an individual laser source associated with that head.

17. A method as claimed in any of claims 12 to 16, wherein the web is advanced stepwise and the laser cutting heads are operated to perform a cutting action defining a label outline only when the web is stationary.

18. A method as claimed in any of claims 12 to 16, wherein the web is advanced continuously and the operation of the cutting heads is synchronised to the advancement of the web whereby the cutting action of each cutting head follows the advancement of the web whilst at the same time cutting the respective part of a label outline.

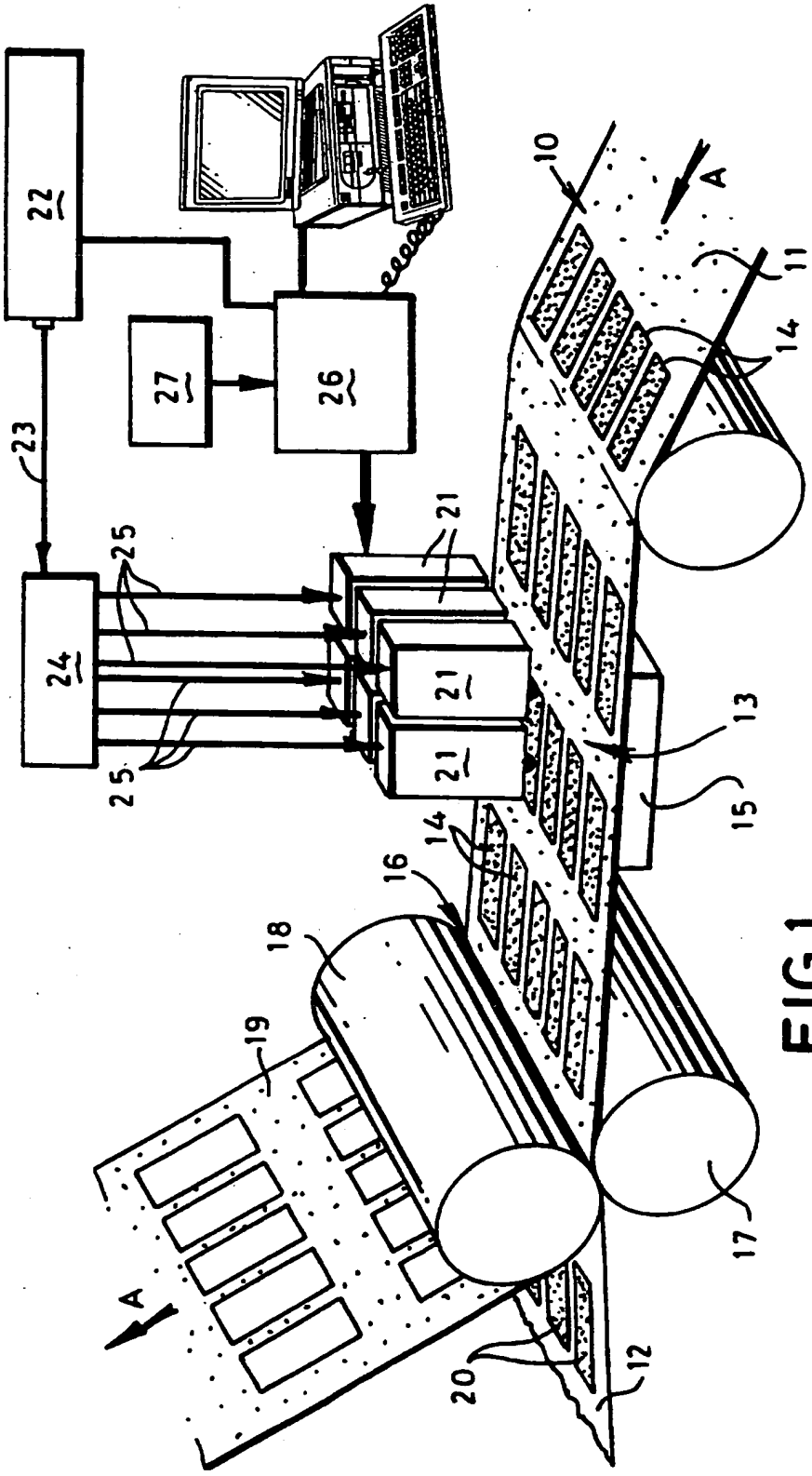

FIG.1

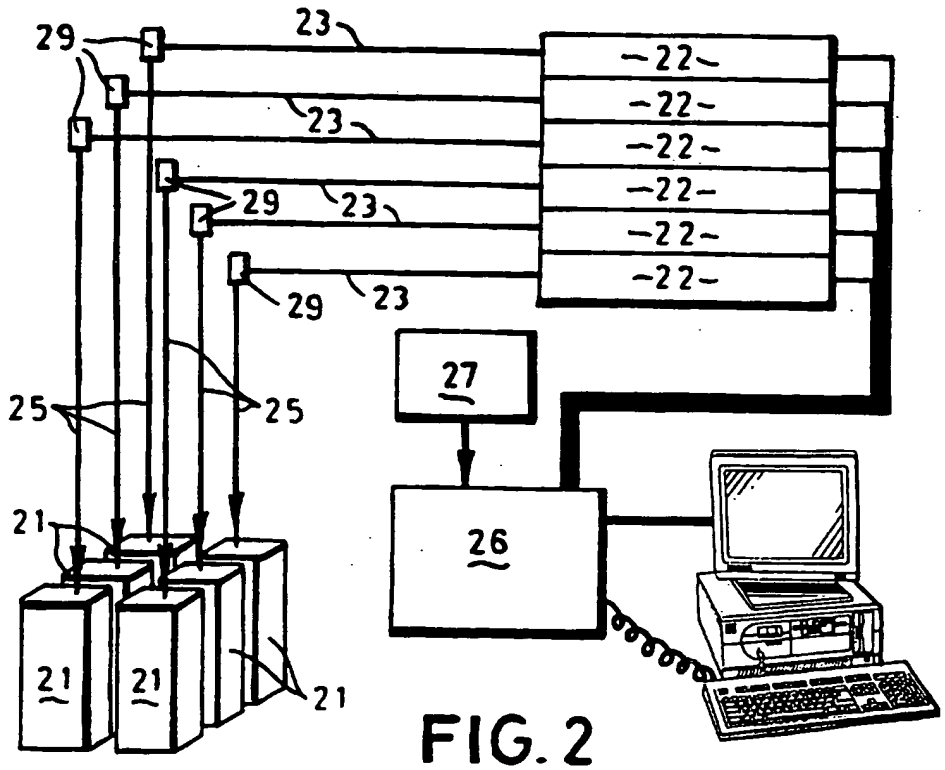
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FIG. 2

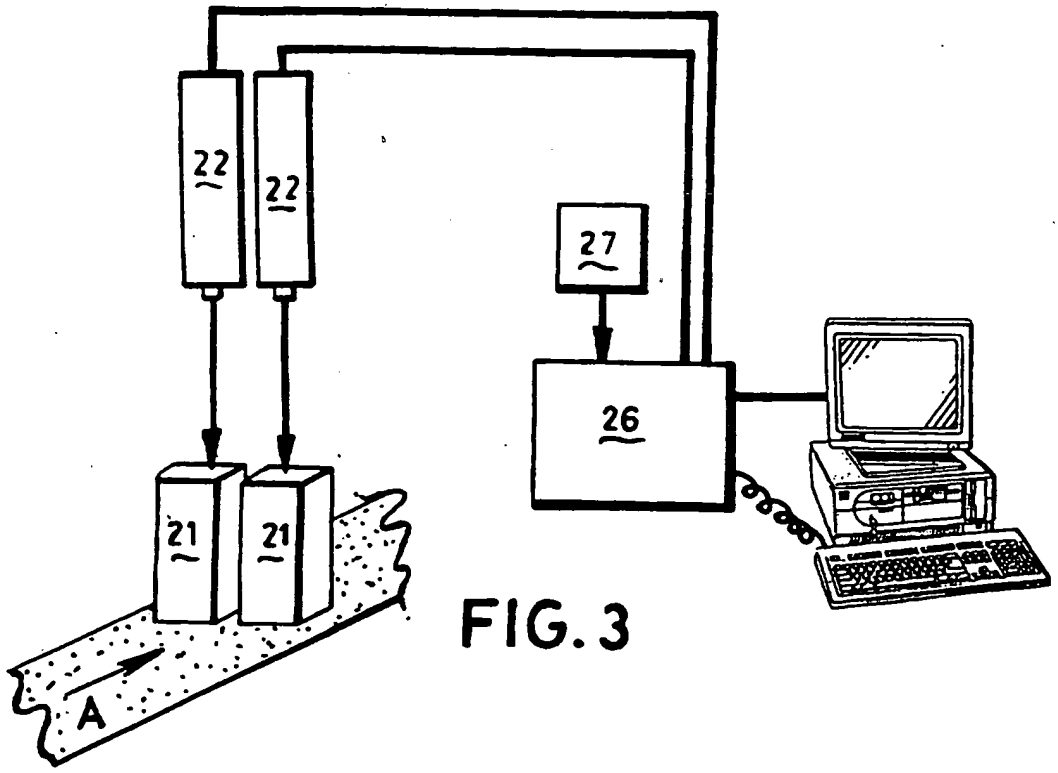
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FIG. 3

INTERNATIONAL SEARCH REPORT

Int ional Application No
PCT/GB 96/02370

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B31D1/02 B23K26/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B31D B23K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO,A,87 00121 (AVERY INTERNATIONAL CORP) 15 January 1987 see page 13, line 1 - line 14; figure 5 ---	1,3,5, 12,14,18
A	WO,A,94 14605 (NEDBLAKE GRAYDON WESLEY ;GARBER JOHN (US)) 7 July 1994 cited in the application see the whole document -----	1-5, 10-13,18

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
20 December 1996	15. 01. 97

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte onal Application No
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
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